Answer Key: Civil Engineering Licensure Exam – Mock Exam (Day 19: Water Supply and Sewerage System Design)

February 24, 2025

Answer Key

Section A: Multiple Choice Solutions

1. Standard per capita water consumption: **(b) 100-200 liters per capita per day**
2. Fire flow demand refers to: **(b) The amount of water required to fight fires**
3. Minimum velocity to prevent sedimentation: **(c) 0.6 m/s**
4. Function of a manhole: **(a) Allow access for inspection and cleaning**
5. Invert level refers to: **(a) The bottom interior surface of a pipe**

Section B: Problem-Solving Solutions

1. Total daily water demand:

$$Q = \text{Population} \times \text{Per capita consumption}$$

$$= 500,000 \times 150 = 75,000,000 \text{ L/day} = 75,000 \text{ m}^3/\text{day}$$

2. Flow velocity in sewer pipe:

$$V = \frac{Q}{A}$$

$$A = \frac{\pi d^2}{4} = \frac{\pi(0.6)^2}{4} = 0.2827 \text{ m}^2$$

$$V = \frac{0.4}{0.2827} = 1.42 \text{ m/s}$$

3. Total fire flow volume:

$$V = Q \times t$$

$$= 30 \times 3600 \times 3 = 324,000 \text{ L} = 324 \text{ m}^3$$

4. Flow velocity using Manning's equation:

$$V = \frac{1}{n} R^{2/3} S^{1/2}$$

$$R = \frac{A}{P} = \frac{\pi(0.8)^2/4}{\pi(0.8)}$$

$$= \frac{0.5027}{2.513} = 0.2 \text{ m}$$

$$V = \frac{1}{0.013}(0.2)^{2/3}(0.002)^{1/2}$$

$$V = 1.56 \text{ m/s}$$

5. Total daily BOD load:

$$\text{BOD Load} = \text{Flow} \times \text{Concentration}$$

$$= (50,000 \text{ m}^3/\text{day}) \times (250 \text{ mg/L})$$

Convert mg/L to kg/m³:

$$= 50,000 \times \frac{250}{1,000,000} = 12.5 \text{ tons/day}$$